

CLAIMS

1. A structure containing polyhydroxyalkanoate and a magnetic substance, comprising:

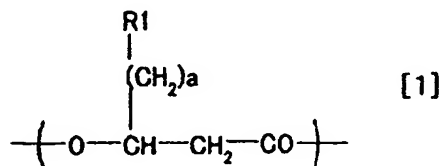
5 an external phase part containing the polyhydroxyalkanoate; and

an internal phase part contained in the external phase part,

at least one of the external phase part and the
10 internal phase part containing the magnetic substance.

2. A structure according to claim 1, wherein the structure is in the form of a microcapsule where the external phase part forms a shell and the
15 internal phase part forms a core.

3. A structure according to claim 1, wherein the polyhydroxyalkanoate comprises polyhydroxyalkanoate including at least one selected
20 from the group consisting of monomer units represented by the following formulae [1] to [10]:



(wherein the monomer unit is at least one selected from the group consisting of monomer units having the

following respective combinations of R1 and a in the formula:

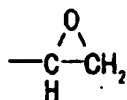
a monomer unit where R1 represents a hydrogen atom (H) and a represents one of the integers from 0 to 10;

a monomer unit where R1 represents a halogen atom and a represents one of the integers from 1 to 10;

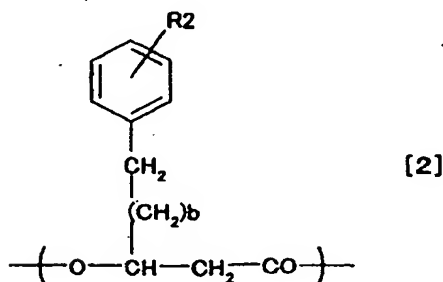
a monomer unit where R1 represents a chromophore and a represents one of the integers from 1 to 10;

a monomer unit where R1 represents a carboxyl group or a salt thereof and a represents one of the integers from 1 to 10; and

a monomer unit where R1 represents



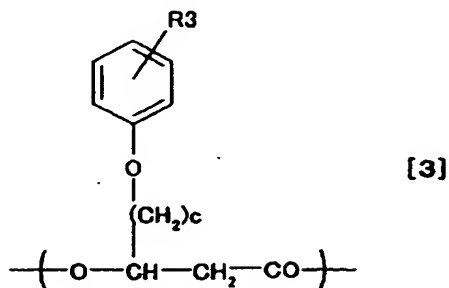
and a represents one of the integers from 1 to 7);



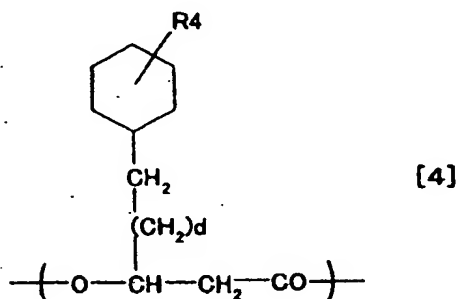
(wherein b represents one of the integers from 0 to 7, and R2 represents one selected from the group

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consisting of a hydrogen atom (H), a halogen atom,
-CN, NO₂, -CF₃, -C₂F₅, and -C₃F₇);

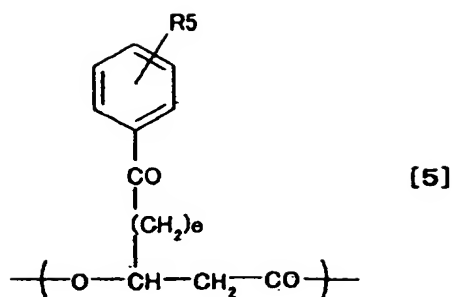


(wherein c represents one of the integers from 1 to 8,
5 and R³ represents one selected from the group
consisting of a hydrogen atom (H), a halogen atom,
-CN, -NO₂, -CF₃, -C₂F₅, and -C₃F₇);

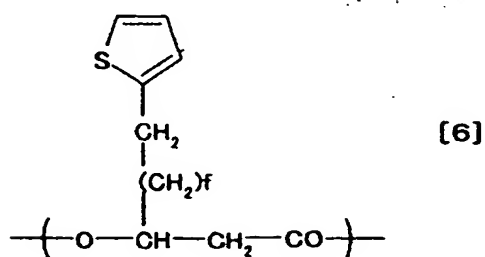


(wherein d represents one of the integers from 1 to 7,
10 and R⁴ represents one selected from the group
consisting of a hydrogen atom (H), a halogen atom,
-CN, -NO₂, -CF₃, -C₂F₅, and -C₃F₇);

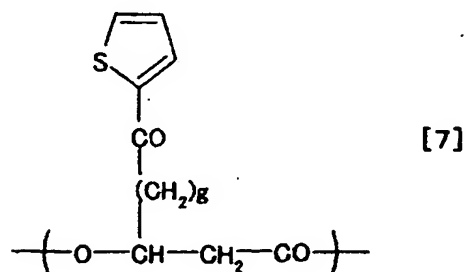
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(wherein e represents one of the integers from 1 to 8,
and R5 represents one selected from the group
consisting of a hydrogen atom (H), a halogen atom,
5 -CN, -NO₂, -CF₃, -C₂F₅, -C₃F₇, -CH₃, -C₂H₅, and -C₃H₇);

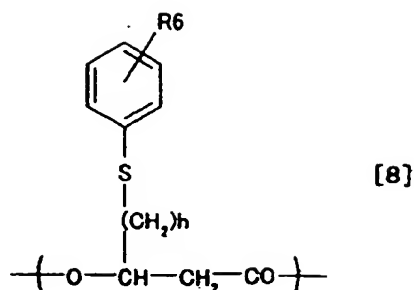


(wherein f represents one of the integers from 0 to
7);

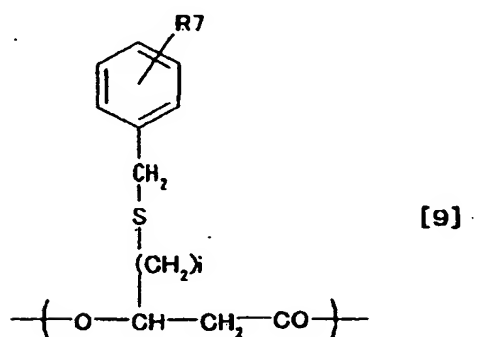


10 (wherein g represents one of the integers from 1 to
8);

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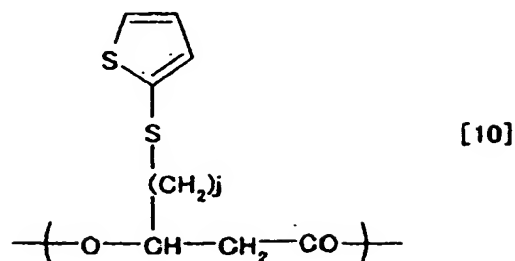
(wherein h represents one of the integers from 1 to 7,
 and R6 represents one selected from the group
 5 consisting of a hydrogen atom (H), a halogen atom,
 -CN, -NO₂, -COOR', -SO₂R'', -CH₃, -C₂H₅, -C₃H₇, -CH(CH₃)₂,
 and -C(CH₃)₃, where R' represents one of a hydrogen
 atom (H), Na, K, -CH₃, and -C₂H₅ and R'' represents one
 of -OH, -ONa, -OK, a halogen atom, -OCH₃, and -OC₂H₅);



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(wherein i represents one of the integers from 1 to 7,
 and R7 represents one selected from the group
 consisting of a hydrogen atom (H), a halogen atom,
 -CN, -NO₂, -COOR', and -SO₂R'', where R' represents one
 15 of a hydrogen atom (H), Na, K, -CH₃, and -C₂H₅ and R''
 represents one of -OH, -ONa, -OK, a halogen atom,

-OCH₃, and -OC₂H₅); and



(wherein j represents one of the integers from 1 to 9).

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4. A structure according to claim 1, wherein the polyhydroxyalkanoate has a number average molecular weight of 5,000 to 1,000,000.

10 5. A structure according to claim 1, wherein a monomer unit composition of the polyhydroxyalkanoate varies in a direction from the inside toward the outside of the structure.

15 6. A structure according to claim 1, wherein at least a portion of the polyhydroxyalkanoate comprises a chemically modified polyhydroxyalkanoate.

20 7. A manufacturing method for a structure having an external phase part containing polyhydroxyalkanoate and an internal phase part contained in the external phase part with at least

one of the external phase part and the internal phase part containing a magnetic substance, comprising the steps of:

preparing a liquid raw material including an
5 oil phase containing polyhydroxyalkanoate and an organic solvent, a water phase, and the magnetic substance; and

removing at least one of the organic solvent and the water from the liquid raw material,

10 the inner phase part being contained in the external phase part including PHA derived from the oil phase or the water phase, and

at least one of the external phase part and the internal phase part containing the magnetic substance.

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8. A manufacturing method for a structure according to claim 7, further comprising the step of preparing an emulsion using the water phase and the oil phase.

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9. A manufacturing method for a structure according to claim 8, further comprising the steps of:

preparing a W/O type emulsion by dispersing the
25 water phase in the oil phase; and

removing at least one of the organic solvent and the water from the W/O type emulsion.

10. A manufacturing method for a structure according to claim 8, further comprising the steps of:

5 preparing a W/O type emulsion by dispersing the water phase in the oil phase:

preparing a W/O/W type emulsion by dispersing the W/O type emulsion in a second water phase; and

removing at least one of the organic solvent and the water from the W/O/W type emulsion.

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11. A manufacturing method for a structure according to claim 8, further comprising the steps of:

15 preparing an O/W type emulsion by dispersing the oil phase in the water phase; and

removing at least one of the organic solvent and the water from the O/W type emulsion.

12. A manufacturing method for a structure according to claim 7, wherein the removal of at least one of the organic solvent and the water is performed by at least one method selected from the group consisting of a submerged drying method, a phase separation method, and a spray drying method.

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13. A manufacturing method for a structure having an external phase part containing

polyhydroxyalkanoate and an internal phase part
contained in the external phase part, at least one of
the external phase part and the internal phase part
containing a magnetic substance, comprising the steps

5 of:

preparing a water phase containing a
polyhydroxyalkanoate synthetic enzyme and a 3-
hydroxyacyl coenzyme A;

10 preparing an oil phase containing an organic
solvent;

preparing an emulsion containing the water
phase, the oil phase, and the magnetic substance;

15 synthesizing polyhydroxyalkanoate by
polymerizing the 3-hydroxyacyl coenzyme A with the
polyhydroxyalkanoate synthetic enzyme in the
emulsion; and

removing at least one of the organic solvent
and the water from the emulsion,

20 the inner phase part being contained in the
external phase part including PHA derived from the
oil phase or the water phase, and

at least one of the external phase part and the
internal phase part containing the magnetic substance.

25 14. A manufacturing method for a structure
according to claim 13, further comprising the steps
of:

preparing a W/O type emulsion by dispersing the water phase in the oil phase; and

removing at least one of the organic solvent and the water from the W/O type emulsion.

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15. A manufacturing method for a structure according to claim 13, comprising the steps of:

preparing a W/O type emulsion by dispersing a first water phase in the oil phase;

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preparing a W/O/W type emulsion by further dispersing the W/O type emulsion in a second water phase; and

removing at least one of the organic solvent and the water from the W/O/W type emulsion.

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16. A manufacturing method for a structure according to claim 15, wherein at least one of the first water phase and the second water phase contains a polyhydroxyalkanoate synthetic enzyme and a 3-

20 hydroxyacyl coenzyme A.

17. A manufacturing method for a structure according to claim 13, further comprising the steps of:

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preparing an O/W type emulsion by dispersing the oil phase in the water phase; and

removing at least one of the organic solvent

and the water from the O/W type emulsion.

18. A manufacturing method for a structure according to claim 13, comprising the steps of:

5 preparing an O/W type emulsion by dispersing a first oil phase in the water phase;

 preparing an O/W/O type emulsion by further dispersing the O/W type emulsion in a second oil phase; and

10 removing at least one of the organic solvent and the water from the O/W/O type emulsion.

19. A manufacturing method for a structure according to claim 14, wherein a composition of a 3-
15 hydroxyalkanoate unit in the polyhydroxyalkanoate varies in a direction from the inside to the outside of the structure by changing a composition of the 3-hydroxyacyl coenzyme A with time.

20 20. A structure according to claim 1, wherein the internal phase contains a pharmaceutical component.